Assembly Guide for Pressure Sensor Die

1. Introduction

This application note is intended to provide a simplified recommendation for assembly with pressure sensor die. Thorough process development and testing of the assembly is still required as every system design may vary and require additional environmental testing.

SMI pressure sensor die are piezo-resistive elements that react to strain and stress with pressure. The assemble process can also affect the pressure sensor die and its measurement. The mounting substrate can vary from a plastic package or Printed Circuit Board (PCB) to a ceramic base.

This guide only addresses the die attach process for low pressure applications with silicone RTV, as the die attach material. Higher pressures may demand stronger die attach methods such as a eutectic bond or an epoxy, hard die attach.

Figure 1: Sensor Die Top View Mechanical Drawing
2. Pick-and-Place Recommendations

- Wafers can contain from 1,000 to over 40,000 sensor die. The sensor can consist of silicon, or silicon/glass stack, with a height of ~0.9 mm.
- Due to the backside hole ejector pins with three or four needles shall be used.
- The sensor die should be picked with a pick-and-place tool. The pick-and-place tool shall be of soft rubber with a clean surface and a vacuum hole in the center with a diameter > 1 mm. The pickup and bond force has to be less than 100 g. Excessive mechanical stress can result in an unstable (drifting) electrical sensor signal.
- As vacuum pressure is used to adhere to the die surface, careful attention to proof and burst pressure must be taken so as to not damage the sensor. Especially for ultra-low pressure sensor die with large, thin membranes.

3. Handling Recommendations

- The wafer surface is very sensitive to scratches, damage, and contamination.
- It is not recommended to manually pick die (e.g. with tweezers).
- Process temperatures above 225°C should be avoided. Typically, lower maximum temperatures lead to improved stability results.

4. Die Attach

For die-attach low hardness silicone glue (e.g., Dow Corning RTV) with a thickness of approximately 250 µm is recommended as shown in Figure 2. Die-attach with hard silicone or epoxy materials will typically result in an unstable performance with low pressure die. Careful attention must be taken to not block venting to the cavity of the sensor backside cavity. Also, the die attach material should not contact the backside cavity and make contact with the membrane. This will affect accurate pressure measurement.
5. Wire Bonding

Bond pad openings of SMI pressure sensor die are typically 100 µm x 100 µm. The pad material is typically aluminum with a thickness of approximately 1 µm. For wire bonding, best results are achieved with 1 mil (~ 25 µm) Au ball-wedge wire bonding similar as shown in Figure 3. Typically process temperatures are 150°C. A good wire bond will result in a ball shear force of greater than 21 grams and a pull force greater than 4 grams.
6. Protective Gel Coating

The sensor can be protected with a soft ion-free silicone gel with a viscosity of < 1000 cps and no hardness. The type of gel is critical for the sensor performance. Good results can be achieved, e.g., with Dow Corning gel. A smaller amount of gel can be applied on the surface of the sensor and wirebond substrate interfaces. Additionally, if further humidity protection is required, the whole area surrounding the sensor including bonding wires can be covered.
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